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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON, D.C. 20546

IN REPLY REFER TO: SB(FHQ:pak)

7 January 1965

AIR MAIL

Dr. Joshua Lederberg  
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Dear Josh:

Dr. Reynolds and I have recently completed a careful reading of your stimulating paper on "Signs of Life: The Criterion - System of Exobiology."

We have only a few comments to make at this time:

The excellent paragraphs on optical activity ended with the statement that "Enantiomorphs can be assayed with optically active reagents to give resolvable diastereo-isomers, and exploit the most sensitive methods known to chemistry." Several pages later under Instrumentation you speak of "molar rotations being small," and suggest that some method of exciting the signal would enormously enhance the power of this technique. Did you separate this discussion for any special reason?

Your paper emphasizes the chemical scan and the sensitivity of chemical measurements. It seems to us that there may be a hazard in establishing such a requirement for all life-related substances. Cannot some methods be too sensitive, or unnecessarily sensitive? All of us have seen the results of good organic chemists, with blanks and other precautions -- who when reporting a few parts per million, could not be sure that the material was indigenous to the sample or already present as a contaminant in the instrument hardware, in "the columns", or introduced during one of the stages of preparation and assay. At any rate we have some reservations that all crucial<sub>3</sub> data for exobiology hinge on  $10^8$  to  $10^4$  molecules in a  $1\text{ cm}^3$  cell.

We wondered a bit why you developed 15 pages of criteria and only 2 pages on instrumentation for such criteria, particularly since you had in an earlier report developed a good case for what you called "A Crises in Instrumentation." We did note that you wrote favorably concerning the gas chromatograph - mass spectrometer combination and are happy about this, since we have recently undertaken to develop such an instrument for flight.

The interplanetary barrier certainly requires repeated emphasis, however, it is hoped that we can solve this problem without the delay and expense of a lunar base. This is particularly true since a quarter million miles may be merely a dog-leg route for contamination in both directions. We prefer to avoid the hazards of back contamination by one-way unmanned missions to Mars. As for the risk of contaminating Mars by these missions, there is a growing confidence now that such risk can be reduced to an acceptable level. This confidence is based upon an ever increasing list of heat resistant electronic components, materials, and instruments. Some of these items are intrinsically heat sterilizable and many others are being so designed. Also procedures and heat treatment cycles are progressing well beyond what we had expected. Preliminary results on many aspects of this overall problem look very encouraging.

It is our hope that an international sense of moral responsibility on this matter will develop. This may indeed be the case if the United States presents a valid argument for spacecraft sterilization and a procedure which is within the technological capability of the USSR. Thus far, we believe it only our good fortune that Russia's deep probe guidance capability leaves the question open for further study and consideration. The solution may be to make not only an initial but a somewhat complete exploration of Mars while it is yet an "unvisited" body in our solar system, and to do so as early as reasonable decontamination precautions permit.

Please accept our sincere appreciation for another vigorous and interesting treatment of exobiology subject matter.

Sincerely,



Freeman H. Quimby  
Chief, Exobiology  
Bioscience Programs  
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and Applications